

# Kentucky Consortium for Carbon Storage

## Eastern Kentucky Deep Storage Focus Group

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# Focus Group Meetings

- Initial consortium meeting on Dec. 7, 2007
- Over 100 in attendance
- Expressed desire to organize overall project by geographic area and project type
- 3 focus groups meeting this week:
  - Wednesday: Western Kentucky deep CO<sub>2</sub> storage
  - Thursday: Eastern Kentucky deep CO<sub>2</sub> storage
  - Friday: Enhanced oil and gas recovery



# Outline

- HB 1 funding and directives
- Kentucky Consortium for Carbon Storage
- Vision and expected results
- Project organization and structure
- Preliminary budget development
- Discussion and questions

# Why Are We Here?

- Kentucky HB 1 was passed in a 2007 special session and signed into law August 30.
- Provides financial incentives for coal gasification plants
- Provides \$5 million for carbon sequestration research in Kentucky
- "The Kentucky Geological Survey is encouraged to use these funds to match available federal and private funds to the extent possible."



# 2007 HB 1 Directives

- Drilling of deep wells in the eastern and western coal fields to estimate sequestration potential
- Quantify the potential for:
  - Enhanced oil and gas recovery
  - Enhanced coalbed methane recovery
- Test the Devonian shale for CO<sub>2</sub> enhanced gas recovery and CO<sub>2</sub> sequestration potential

# Vision

- \$5 million is not sufficient to accomplish everything in HB 1
- A joint industry–government consortium is the only way to achieve these objectives
- The **Kentucky Consortium for Carbon Storage** (KYCCS) has been formed by KGS



# Consortium Model

- Industry involvement is necessary for the success of this project
  - Cost sharing
  - Guidance and direction of research
  - Provide expertise not available at KGS
  - Justification of the Commonwealth's investment in carbon management research

# Today's Goals

## Morning

- Identify likely members of Eastern Kentucky project
- Create a Project Advisory Committee and define its responsibilities
- Discuss and agree on funding structure, funding levels, deadline for participation, other concerns

## Afternoon

- Present our initial technical approach
- Discuss preliminary budget??



# HB 1 Research Organization: 3 Subprojects

- Western Kentucky Deep Sequestration
  - Rick Bowersox and Dave Williams
- Eastern Kentucky Deep Sequestration
  - Steve Greb and Warren Anderson
- CO<sub>2</sub> EGR/EOR
  - Devonian shale CO<sub>2</sub> EGR, Brandon Nuttall
  - CO<sub>2</sub> EOR, Marty Parris
  - Enhanced coalbed methane production, Cortland Eble
- Public Education and Outreach
  - Mike Lynch

# Subproject Integration

- Subprojects will run concurrently
- Communication between teams important
- Efforts will be made to coordinate work schedules and contracts to extent possible for cost savings
  - Seismic acquisition, drilling

# Eastern Ky. Project Goal

Identification, characterization, and testing of  
CO<sub>2</sub> storage in saline reservoirs in Eastern  
Kentucky

Will be accomplished by drilling of a deep well  
to test multiple potential target zones



# Impact of Results

- Kentucky geology is not homogeneous
- Research sites will be as representative as possible, however:
  - A successful project will not prove sequestration is possible everywhere, and an unsuccessful project will not condemn the entire state
- We cannot guarantee success – there is risk involved

# Project Structure

- Industry cost-share to be administered separately by subproject
- University of Kentucky Research Foundation (UKRF) is a not-for-profit 501(c)(3) corporation
- This existing legal structure should suffice for tax benefits to contributors
- Maximum tax benefits may be realized through a gift mechanism, but this would preclude direct benefit or involvement in project decisions



# Another Option

- The western Kentucky group has decided to form a separate 501(c)(3) corporation to handle the industry cost share funds. Advantages include:
  - Liability protection
  - Avoid university overhead fees
  - More control/governance on industry money

# Project Advisory Committees (PACs)

- Separate advisory committees proposed for 3 subprojects
- Equal representation from major participating companies, the Commonwealth, and KGS
- Advisory committee responsibilities:
  - Major project decision points
  - Major expenditures
  - Main contact point for communications
  - Technical support, guidance, and oversight



# PAC

- HB 1 mandates that KGS lead the technical effort with input and collaboration from partners
- KGS to evaluate sites and develop objectives based on technical merit
- KGS will present major project decisions to PAC for agreement on significant expenditures



# Liability of Sponsors

- Sponsor liability for university research:
  - UK cannot indemnify sponsors, but we know of no case where a sponsor has been held liable for research activity
  - UK legal counsel is currently looking into this
- Liability related to injected CO<sub>2</sub> is a concern in all CO<sub>2</sub> projects (like FutureGen)
  - This project will involve small volumes of CO<sub>2</sub>
  - Will follow lead established by DOE demonstration projects
  - Liability insurance could be explored

# Confidentiality

- Data and results of project to be published
  - No confidentiality
- Confidential data provided by consortium members to aid in regional or site evaluation will be held confidential within the consortium

# Fate of the Well

- Various options for the well after research is completed
  - Well plugged and site reclaimed
  - Possible sale to mineral rights owner if hydrocarbons are encountered
  - Possible use for future CO<sub>2</sub> injection

# Probable Participants

## Western Kentucky Deep Storage

- Commonwealth of Kentucky
  - Portion of \$5,000,000 total funding (to be determined)
- Crossrock Drilling
  - Bids on drilling of eastern and western deep wells (no mention of in-kind contribution)
- Interstate Natural Gas
  - Engineering services, oil wells, Devonian Shale wells
- Schlumberger Carbon Services
  - Consulting services, discounted logging and well services, Petrel and ECLIPSE software donation



# Pending Participants

## Western Kentucky Deep Storage

- Chesapeake Energy
  - Drill site near Big Sandy power plant; financial and in-kind resources
- Pine Mountain Regional Industrial Development Authority
  - Drill site and partial well costs

# Federal Cost Share

- Several options to obtain federal matching dollars
- No federal dollars identified yet for Eastern Kentucky project
- Appalachian Basin DOE partnership (Battelle) a possibility

# Project Schedule

- Eastern Kentucky project to require approximately 2 years for completion
- Site and target selection: by Summer 2008
- Seismic acquisition/interpretation: Summer/Fall 2008
- Well design/permitting: Fall/Winter 2008
- Drilling: Spring 2009
- Testing/injection to follow

# Discussion Points

- Project Advisory Committees
- Liability concerns
- Project schedule
  - Organization and participation deadline
  - Technical milestones
- Identification of additional participants
- Budget
  - Financial contributions: equal shares or variable?



# Deep Saline Reservoir Projects

- Tests in eastern and western Kentucky
- Depths >2,500 ft; likely 5,000 to 9,000 ft range
- Injection tests with either water or CO<sub>2</sub>
- Locations to be chosen to provide most data on multiple target zones
- No sites have been considered yet
- Agreement with mineral owner to buy back the well if hydrocarbons are encountered possible

# Technical Work: Deep Wells

- Obtain whole core and side-wall cores in reservoir and seal intervals
- Run and interpret extensive suite of well logs
- Collect brine samples from target zones for geochemistry
- Analyze core samples for porosity, permeability, mineralogy, mechanical strength, and other physical properties
- Conduct injection tests using fluid, air or CO<sub>2</sub>
- Public education and outreach
- Reporting and technology transfer

# Deep Wells

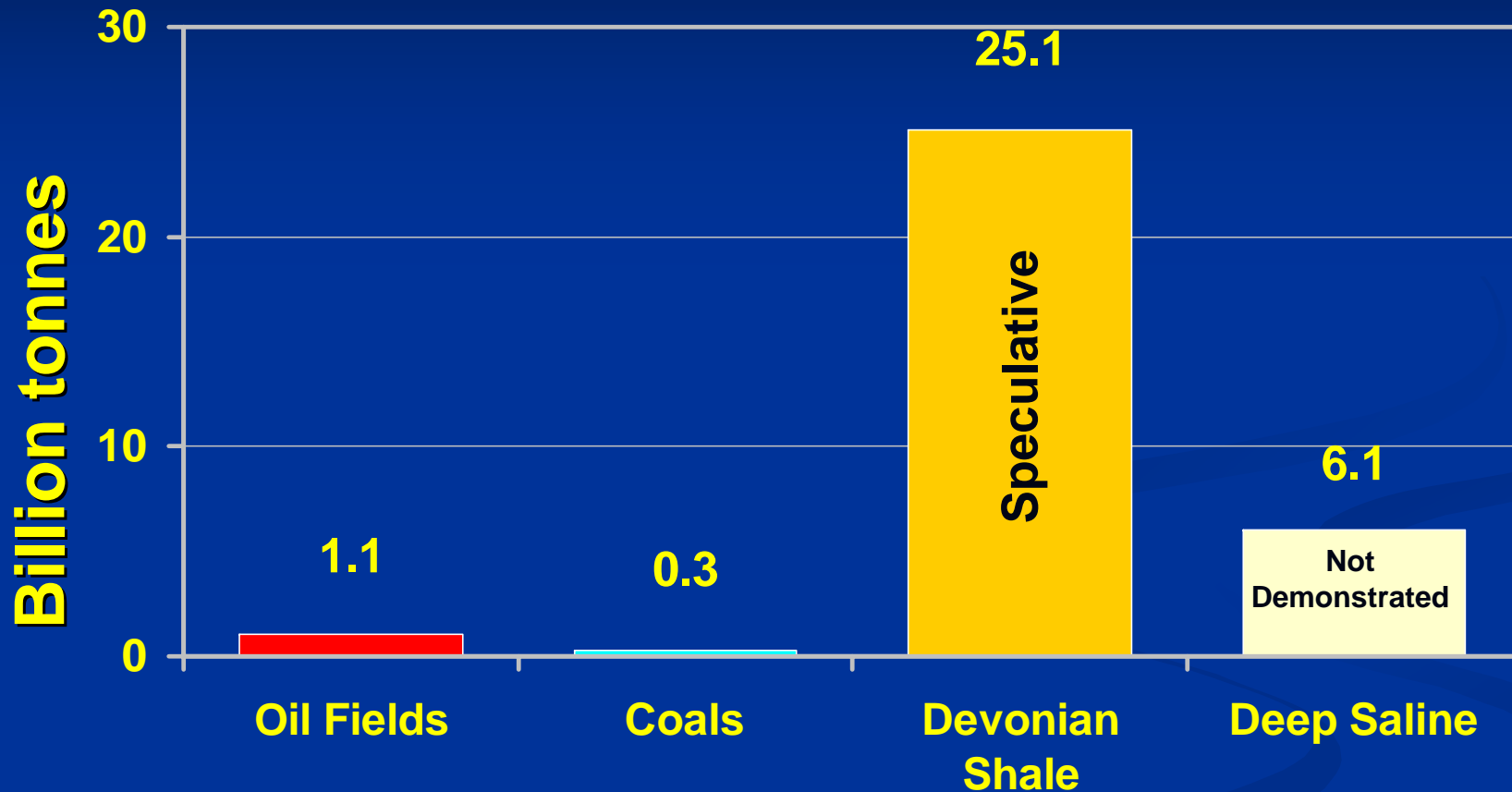
- Site characterization by KGS and consortium members
  - Subsurface mapping
  - Purchase existing seismic data; acquire new seismic
  - Evaluation of well logs, cores, and well samples
  - Characterize seals
  - Design monitoring plan (subsurface and surface)
  - Permit wells according to regulations for oil & gas wells or EPA-regulated injection wells.
- Well design and engineering
  - Outside consultants and consortium members



# Well Design and Engineering

- KGS lacks in-house petroleum engineering expertise
- Outside consultants will be used for design of EOR projects, wells, injection tests, and operations oversight
- Will seek in-kind contributions from service companies

# DOE Phase I CO<sub>2</sub> Storage Estimates



While CO<sub>2</sub> EOR potential is significant, deep saline or Devonian shale storage will be needed to handle expected volumes

# What's Next?

- Participation decisions requested by Jan. 15
  - Consortium will remain open after that date
- We expect the level of industry funding will vary
- In-kind participation is welcomed
- A company's participation and funding level cannot be held confidential
- Project results to released immediately

# Proposed Program Budget Eastern Kentucky Subproject

State Funds	Industry Match	DOE & other states	Total
\$ 1.35M	\$1.35M	\$0.5M	\$3.2M

Budget for 7,500 foot injection well in Decatur, Illinois is \$4.1M



# Triana Energy Rome Wells Clark County, Ky.

- Triana Energy recently drilled 3 wells to Precambrian basement in Clark County
- Two of the wells have been offered to the project for possible use in CO<sub>2</sub> sequestration
- Cost would be salvage value of the casing (\$15-20K)
- Excellent sandstone reservoir quality at depths of 3500- 4200 ft.
  - 600 ft of gross interval, porosity of 10-15%



# Clark County Deep Wells

